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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,112	03/12/2004	Yuxiang May Wang	008245/DSM/BCVD	8920

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EXAMINER	
DAHIMENE, MAHMOUD	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 04/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/800,112	WANG ET AL.	
	Examiner	Art Unit	
	Mahmoud Dahimene	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 February 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 6/10/04, 8/1/05, 11/14/05
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Arguments

1. Applicant's arguments, see pages 7-14, filed on 02/08/2006, have been fully considered and are persuasive.

With regard to claims 16, 17, 20-22, the rejection under 35 U.S.C. §112, second paragraph has been withdrawn in view of applicant's amendments.

As to claims 1,2,7-10, 16-18 , Rui et al does not teach, show, or suggest forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula CxHy, wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, as recited in claims 1, 9 , rejection of those claims under 35 U.S.C. §102(e) is therefore withdrawn.

As to the rest of the claims rejected under 35 U.S.C. §103(a), rejection is withdrawn in view of the submitted statement of common ownership filed on 02/08/2006.

However, upon further consideration, a new ground(s) of rejection is made in view of Dakshina-Murthy et al. (US 6,884,733) and Yang et al. (US 2003/0003771).

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 1, 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dakshina-Murthy et al. (US 6,884,733) in view of Yang et al. (US 2003/0003771).

The reference of Dakshina-Murthy discloses use of amorphous carbon hard mask for gate patterning, the method comprises forming a conductive material layer (50) on a surface of the substrate (column 4, lines 53-64),

depositing an amorphous carbon layer (60) on the conductive material layer (column 5, line 42) by a method comprising:

introducing into the processing chamber one or more hydrocarbon

compounds having the general formula CxHy such as Ethylene or propylene (column 5, line 48). And generating a plasma of the one or more hydrocarbon compounds (column 5, line 49)

etching the amorphous carbon layer to form a patterned amorphous carbon layer (figure 8); and

etching feature definitions in the conductive material layer corresponding to the patterned amorphous carbon layer (figure 9).

A difference is noted between applicant's claim 1 and the reference of Dakshina-Murthy, Dakshina-Murthy fails to discloses a dual-frequency plasma for the PECVD deposition.

The reference of Yang describes a process where a dual-frequency plasma is used for deposition of an amorphous carbon layer using C_2H_4 or C_2H_6 gases (page 7, claim 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the process of Dakshina-Murthy to use the dual-frequency method of Yang for forming the amorphous carbon layer because Yang teaches dual-frequency is conventionally used for amorphous carbon layer deposition. One of ordinary skill in the art would have been motivated to use a dual-frequency deposition method in order to obtain a high-quality dense deposit yielding a compact structure (as taught by Yang, page 2, paragraph 0016) which is desirable for a masking layer to minimize erosion during the subsequent conductive etch step.

As to claims 3 and 6, a difference is noted between applicant's claims 3 and 6 and the reference of Dakshina-Murthy, Dakshina-Murthy fails to discloses power levels as well as the two frequencies.

The reference of Yang discloses 200 watts at 13.56 MHz and 200 watts at 500 KHz for the deposition plasma (page 2, paragraph 0016).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the process of Dakshina-Murthy to use the frequencies and power levels as described above because those condition are disclosed by Yang. One of ordinary skill in the art would have been motivated to use proven deposition conditions disclosed in the literature in order to obtain a reliable product while reducing costly process development time.

As to claim 4, see rejection in reference to claim 1.

As claim 5, Dakshina-Murthy discloses inert ions may be introduced into the amorphous carbon layer (column 6, line 33). One of ordinary skill in the art would also know that inert gases are conventionally used for diluting gases in plasma which is a way of introducing inert ions during deposition.

As claim 7, Dakshina-Murthy discloses "One advantageous feature of providing amorphous carbon layer 60 that may be produced with various thicknesses is that amorphous carbon layer 60 may be produced in a thickness suitable for patterning layer of conductive or semiconductive material 50. For example, where a particular thickness of polysilicon is provided, the thickness of amorphous carbon layer 60 may be altered so that the proper amount of mask material is provided over the

polysilicon material to compensate for the etch selectivities of the materials used. This allows for increased manufacturing efficiency by eliminating unnecessary material use" (column 5, line 64) which means one of ordinary skill in the art could select the desired selectivity.

As to claim 8, Dakshina-Murthy discloses an ARC layer (70) (column 7, line 10).

Claim Rejections - 35 USC § 103

2. Claims 2, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dakshina-Murthy et al. (US 6,884,733) in view of Yang et al. (US 2003/0003771) as applied to claim 1 above, and further in view of Park et al. (US 2004/0224241).

A difference is noted between applicant's claim 2 and the reference of Dakshina-Murthy, Dakshina-Murthy fails to discloses a an aluminum or aluminum alloy for the conductive gate material (50).

The reference of Park discloses aluminum alloys are conventionally used as gate conductors (page 1, paragraph 0006).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the process of Dakshina-Murthy to use the aluminum alloy gate conductor of Park because Park discloses aluminum alloys are conventionally used as gate conductors. One of ordinary skill in the art would have been motivated to use an aluminum alloy as the gate conductor instead of polysilicon in order to reduce signal delay due to the low resistivity of the material. The amorphous carbon layer will still be used as a mask.

Claim Rejections - 35 USC § 103

3. Claims 9, 11-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dakshina-Murthy et al. (US 6,884,733) in view of Yang et al. (US 2003/0003771).

The reference of Dakshina-Murthy discloses use of amorphous carbon hard mask for gate patterning, the method comprises forming a conductive material layer (50) on a surface of the substrate (column 4, lines 53-64),

depositing an amorphous carbon layer (60) on the conductive material layer (column 5, line 42) by a method comprising:

introducing into the processing chamber one or more hydrocarbon compounds having the general formula CxHy such as Ethylene or propylene (column 5, line 48). And generating a plasma of the one or more hydrocarbon compounds (column 5, line 49)

depositing an anti-reflective coating (70) on the amorphous carbon hard mask (figure 5)

depositing a patterned resist material (80) on the anti-reflective coating,

etching the anti-reflective coating and amorphous carbon hardmask to the conductive material layer (figure 8), and etching feature definitions in the conductive material layer (figure 9).

A difference is noted between applicant's claim 9 and the reference of Dakshina-Murthy, Dakshina-Murthy fails to discloses a dual-frequency plasma for the PECVD deposition.

The reference of Yang describes a process where a dual-frequency plasma is used for deposition of an amorphous carbon layer using C_2H_4 or C_2H_6 gases (page 7, claim 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the process of Dakshina-Murthy to use the dual-frequency method of Yang for forming the amorphous carbon layer because Yang teaches dual-frequency is conventionally used for amorphous carbon layer deposition. One of ordinary skill in the art would have been motivated to use a dual-frequency deposition method in order to obtain a high-quality dense deposit yielding a compact structure (as taught by Yang, page 2, paragraph 0016) which is desirable for a masking layer to minimize erosion during the subsequent conductive etch step.

As to claim 11, see rejection in reference to claim 3.

As to claim 12, see rejection in reference to claim 4.

As to claim 13, see rejection in reference to claim 5.

As to claim 14, see rejection in reference to claim 6.

As to claim 15, Dakshina-Murthy discloses an ARC layer (70) made of silicon nitride (column 7, line 12).

As to claim 16, a difference is noted between applicant's claim 16 and the reference of Dakshina-Murthy, Dakshina-Murthy fails to disclose a barrier layer.

The reference of Yang cites it is conventional to deposit a barrier layer (136) prior to deposition of the conductive layer (page 5, paragraph 0057).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the process of Dakshina-Murthy to add the step of depositing a barrier layer prior to deposition of the conductive layer because the reference of Yang teaches barrier layers are conventionally used. One of ordinary skill in the art would have been motivated to use a barrier layer in order to prevent diffusion of the conductive material into the adjacent layer(s).

As to claim 17, Dakshina-Murthy shows all photoresist (88 and 90) is removed (figure 8) prior to etching conductive layer (50).

As claim 18, Dakshina-Murthy discloses "One advantageous feature of providing amorphous carbon layer 60 that may be produced with various thicknesses is that amorphous carbon layer 60 may be produced in a thickness suitable for patterning layer of conductive or semiconductive material 50. For example, where a particular thickness of polysilicon is provided, the thickness of amorphous carbon layer 60 may be altered so that the proper amount of mask material is provided over the polysilicon material to compensate for the etch selectivities of the materials used. This allows for increased manufacturing efficiency by eliminating unnecessary material use" (column 5, line 64) which means one of ordinary skill in the art could select the desired selectivity.

Claim Rejections - 35 USC § 103

4. Claims 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dakshina-Murthy et al. (US 6,884,733) in view of Yang et al. (US 2003/0003771) as applied to claim 1 above, and further in view of Park et al. (US 2004/0224241).

All the limitations in applicant's claim 19 have been addressed in reference to rejections of claims 1-18 above, namely

A method for processing a substrate in a chamber, forming an aluminum-containing layer on a surface of the substrate (see claim 2 above),

depositing an amorphous carbon hardmask on the aluminum-containing layer by a method comprising:

introducing into the processing chamber one or more hydrocarbon compounds having the general formula CxHy, wherein x has a ranqe of 2 to 4. and y has a range of 2 to 10 (see claim 1), and

generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source (see claim 1 above),

depositing an anti-reflective coating on the amorphous carbon hardmask, wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof (see claims 8, 9),

depositing a patterned resist material on the anti-reflective coating (see claim 9),

etching the anti-reflective coating and amomhous carbon hardmask to the aluminum-containing layer (see claim 9 above);

removing the resist material (see claim 17 above),

etching feature definitions in the aluminum-containing layer at an etch selectivity of amorphous carbon to the aluminum-containing between about 1:3 and about 1:10 (see claim 18 above),

As to the limitation of removing the one or more amorphous carbon layers by exposing the one or more amorphous carbon Layers to a plasma of a hydrogen-containing gas or an oxygen-containing gas, Dakshina-Murthy discloses "In a step 310, amorphous carbon features 62, 64 are removed after layer of conductive or semiconductive material 50 is patterned (e.g., to form gate conductors 30, 32 shown in FIG. 1). Amorphous carbon features 62, 64 may be removed using methods similar to those described above. For example, the amorphous carbon may be removed using an oxygen-containing plasma" (column 8, line 63).

As to claim 20, see rejection in reference to claim 4.

As to claim 21, see rejection in reference to claim 5.

As to claim 22, see rejection in reference to claim 6.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahmoud Dahimene whose telephone number is (571) 272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MD

NADINE NORTON
SUPERVISORY PATENT EXAMINER